

REMARKS

Pursuant to the present amendment, claims 1, 4, 5, 14, 17 and 20 have been amended and claims 2, 3 and 15 have been canceled. Thus, claims 1, 4-14 and 16-23 are pending in the present application. No new matter has been introduced by way of the present amendment. Reconsideration of the present application is respectfully requested.

As an initial matter, the Examiner objected to the drawings due to the inclusion of the reference number 114, which was not mentioned in the specification. Submitted herewith is an amendment to the specification wherein reference to the number "114" has been added. Withdrawal of the objection is respectfully requested.

In the Office Action, claim 15 was indicated to be allowable if rewritten in independent from. Pursuant to the present amendment, independent claim 14 has been amended to re-present dependent claim 15 in independent form. Thus, it is believed that claims 14 and 16 are in condition for immediate allowance.

In the Office Actions, claims 1-13 and 17-23 were rejected under 35 U.S.C. § 102 as allegedly being anticipated by Wang '769 (U.S. Patent Publication No. 2004/0134769). Claims 1, 6-14 and 16 were rejected under 35 U.S.C. § 102 as allegedly being anticipated by Wang '422 (U.S. Patent Publication No. 2003/0209422). Claims 1, 6, 8, 9, 11, 13, 14 and 16 were rejected under 35 U.S.C. § 102 as allegedly being anticipated by Manabe (U.S. Patent No. 6,380,058). Claims 1, 6, 7, 11 and 14 were rejected under 35 U.S.C. § 102 as allegedly being anticipated by Wang '570 (U.S. Patent No. 5,108,570). Applicants respectfully traverse the Examiner's rejections.

As the Examiner well knows, an anticipating reference by definition must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim.

In re Bond, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). To the extent the Examiner relies on principles of inherency in making the anticipation rejections in the Office Action, inherency requires that the asserted proposition necessarily flow from the disclosure. *In re Oelrich*, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981); *Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1463-64 (Bd. Pat. App. & Int. 1990); *Ex parte Skinner*, 2 U.S.P.Q.2d 1788, 1789 (Bd. Pat. App. & Int. 1987); *In re King*, 231 U.S.P.Q. 136, 138 (Fed. Cir. 1986). It is not enough that a reference could have, should have, or would have been used as the claimed invention. “The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *Oelrich*, at 326, quoting *Hansgirg v. Kemmer*, 40 U.S.P.Q. 665, 667 (C.C.P.A. 1939); *In re Rijckaert*, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993), quoting *Oelrich*, at 326; see also *Skinner*, at 1789. “Inherency ... may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *Skinner*, at 1789, citing *Oelrich*. Where anticipation is found through inherency, the Office’s burden of establishing *prima facie* anticipation includes the burden of providing “...some evidence or scientific reasoning to establish the reasonableness of the examiner’s belief that the functional limitation is an inherent characteristic of the prior art.” *Skinner* at 1789.

Moreover, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s

disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); M.P.E.P. § 2142. Moreover, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); M.P.E.P. § 2143.03.

With respect to alleged obviousness, there must be something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561 (Fed. Cir. 1986). In fact, the absence of a suggestion to combine is dispositive in an obviousness determination. *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573 (Fed. Cir. 1997). The mere fact that the prior art can be combined or modified does not make the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990); M.P.E.P. § 2143.01. The consistent criterion for determining obviousness is whether the prior art would have suggested to one of ordinary skill in the art that the process should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. Both the suggestion and the expectation of success must be founded in the prior art, not in the Applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988); M.P.E.P. § 2142.

Pursuant to the present amendment, independent claim 1 has been amended to specifically recite that the method is directed to the formation of a barrier layer. Moreover, independent claim 1 has been amended to recite that the bias voltage and a pressure of the deposition atmosphere in the first state is selected so as to obtain a thickness of the first layer that is greater at an upper portion of the opening as compared to a bottom portion of the opening and

that a bias voltage and a pressure of the deposition atmosphere in the second state is selected so as to obtain a thickness of the second layer that is greater at a bottom portion of the opening as compared to a top portion of the opening. As thus amended, it is respectfully submitted that claim 1, and all claims depending therefrom, are in condition for immediate allowance.

It is respectfully submitted that Wang '769 does not anticipate nor render obvious claim 1. First, independent claim 1 has been amended to clearly recite that the claimed method is directed to the formation of a barrier layer. Wang '769 is directed to a method of forming conductive material, *e.g.*, copper, in a particular sequence. Importantly, the process sequence the Examiner relied on in rejecting original claim 1 was directed to the formation of copper, not to the formation of a barrier layer. Wang '769 states that the barrier layer 6 may be formed by well-known techniques. ¶¶ 42, 43.

Second, Wang '769 discloses a two-step process for filling the bottom holes 60, 62 and the trench 64. ¶¶ 40, 44. The first step involves forming a layer 82 that fills the vias 60, 62 and provides a relatively thin trench floor portion 86. The first step also results in localized cusps 90. ¶ 44; Figure 5. The second step disclosed in Wang '769 involves filling the trench 64 above the layer 82, a so-called non-conformal and partially filling copper seed layer. ¶ 62. This copper fill process may be performed using an electrochemical plating process.

Thus, Wang '769 certainly does not disclose forming a barrier layer wherein a bias voltage and pressure are selected such that the bias voltage and a pressure of the deposition atmosphere in the first state is selected so as to obtain a thickness of the first layer that is greater at an upper portion of the opening as compared to a bottom portion of the opening and that a bias voltage and a pressure of the deposition atmosphere in the second state is selected so as to obtain

a thickness of the second layer that is greater at a bottom portion of the opening as compared to a top portion of the opening.

Wang '422 is understood to be directed to a method of depositing a film on a substrate. Abstract. Wang '422 discloses applying DC power to a sputter target and sputtering material from the target onto the substrate. After the sputtering process is performed, a high frequency power is applied to the target to form a plasma that will sputter material from the bottom of a feature on the substrate. ¶¶ 8-9. Thus, Wang '422 is believed to be very far afield from the invention set forth in amended independent claim 1. For example, Wang '422 is not understood to be directed to the formation of a barrier layer by establishing first and second states wherein the first and second layers have the thickness characteristics recited in claim 1. Thus, it is respectfully submitted that Wang '422 does not anticipate amended independent claim 1.

Wang '570 likewise does not anticipated amended independent claim 1. Wang '570 is understood to be directed to an improved process for sputtering an aluminum layer on a wafer. Col. 2, ll. 21-27. Wang '570 is believed to be very far afield from the invention recited in independent claim 1. For example, Wang '570 is not directed to the formation of first and second layers having the thickness limitations now recited in amended independent claim 1.

Amended independent claim 1 is likewise not anticipated by Manabe. Although Manabe is directed to a method of forming a barrier layer, at no point does Manabe disclose or even suggest that the method should involve establishing first and second states wherein the first and second layers are formed to the thickness characteristics set forth in amended independent claim 1.

Manabe notes that, in conventional sputtering techniques, a barrier layer is formed only at an upper portion and not on the bottom surface of the hole. Col. 1, ll. 31-37. This ultimately

resulted in a poor connection to the underlying structure. Manabe goes on to describe a two-step process wherein a first film is formed at a relatively low deposition pressure to thereby form the first layer on the bottom surface of the through hole. Col. 13, ll. 34-53. In the second step, the deposition pressure is increased such that the thickness of the second layer is more uniform at the upper portion of the hole. Col. 3, ll. 54-62. However, at no point does Manabe disclose or suggest performing the detailed methodology set forth in amended independent claim 1. More specifically, Manabe does not disclose the method wherein the deposition atmosphere is established in first and second states such that the first and second layers have the thickness characteristics set forth in amended independent claim 1.

Moreover, there is no suggestion in the art of record to modify the prior art as to arrive at Applicants' invention, as defined by amended independent claim 1. If anything, the prior art of record, particularly Manabe, teaches away from the present invention. That is, although Manabe discloses a two-step process for forming a barrier layer, it does it in a way that is fundamentally different from the method recited in amended claim 1. There is certainly no suggestion in Manabe to form the first layer such that it has a thickness that is greater at an upper portion of the opening as compared to the bottom portion of the opening. Similarly, there is no suggestion in the art of record, including Manabe, to form the second layer such that it has a thickness that is greater at the bottom portion of the opening as compared to the top portion of the opening.

It is respectfully submitted that any attempt to assert that amended independent claim 1 is obvious in view of the art of record is necessarily based on an improper use of hindsight using Applicants' disclosure as a roadmap. A recent Federal Circuit case makes it crystal clear that, in an obviousness situation, the prior art must disclose each and every element of the claimed invention, and that any motivation to combine or modify the prior art must be based upon a

suggestion in the prior art. *In re Lee*, 61 U.S.P.Q.2d 143 (Fed. Cir. 2002). Conclusory statements regarding common knowledge and common sense are insufficient to support a finding of obviousness. *Id.* at 1434-35.

In view of the foregoing, it is respectfully submitted that amended independent claim 1, and all claims depending therefrom, are in condition for immediate allowance.

Amended independent claim 17 is likewise believed to be allowable over the prior art of record. As amended, independent claim 17 is directed to a method of forming a barrier layer wherein the bias power and pressure are selected to provide a greater thickness of the conductive material at an upper portion of the opening as compared to the lower portion of the opening. The method continues with the recited step of increasing the bias power and pressure, and continuing the deposition process to predominately deposit the conductive material at the lower portion of the opening. Such a methodology is simply not disclose or suggested by the prior art of record.

It is believed that amended independent claim 17 is distinguishable from the prior art of record for at least some of the reasons set forth above with respect to amended independent claim 1. That is, the prior art of record does not disclose or suggest forming the conductive material such that it has a greater thickness at the upper portion of the opening, increasing the bias power and pressure and continuing the formation of the conductive material to predominately deposit the conductive material at the lower power. Manabe teaches away from such a process. For at least this reason, it is respectfully submitted that amended independent claim 17, and all claims depending therefrom, are in condition for immediate allowance.

In view of the foregoing, it is respectfully submitted that all pending claims are in condition for immediate allowance. The Examiner is invited to contact the undersigned attorney

at (713) 934-4055 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,

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